CLAIMS

1) A method for making a crystalline silicoaluminophosphate (SAPO) membrane, the method comprising the steps of:

a) providing a porous support having a pore size greater than about 0.2 micron;

b) preparing an aqueous SAPO forming gel comprising an organic templating agent;

c) aging the gel;

d) contacting the porous support with the aged gel;

e) heating the porous support and the gel to form a layer of SAPO crystals on the surface of the support; and

f) calcining the SAPO layer to remove the templating agent.

2) The method of claim 1, wherein the SAPO is selected from the group consisting of SAPO-5, SAPO-11, SAPO-16, SAPO-17, SAPO-20, SAPO-31, SAPO-34, SAPO-35, SAPO-37, SAPO-40, SAPO-41, SAPO-42, and SAPO-44.

3) The method of claim 2, wherein the SAPO is SAPO-5, SAPO-11, or SAPO-34.

4) The method of claim 3, wherein the SAPO is SAPO-34.

5) The method of claim 1, wherein the porous support has a pore size large enough so that SAPO crystals can also form inside the pores of the support.

6) The method of claim 5, wherein the porous support has a pore size greater than about 1 micron.

7) The method of claim 1, wherein said support and said gel are heated to a temperature between about 420 K and about 500 K and the gel comprises: 1.0 Al_2O_3: aP_2O_5: $bSiO_2$: cR: dH_2O where R is a quaternary organic ammonium templating agent and

a is between about 0.01 and about 52,
b is between about 0.03 and about 196,
c is between about 0.2 and about 5, and
d is between about 20 and about 300.

8) The method of claim 7, where the SAPO is SAPO-34, R is tetra-ethyl ammonium hydroxide and
a is about 1
b is about 0.6
c is about 1.07 and
d is about 56.

9) The method of claim 1, wherein the gel is aged at least 24 hours between about 290 K and about 300 K.

10) The method of claim 4, wherein the gel is aged at least 24 hours between about 290 K and about 300 K.

11) The method of claim 10, wherein the gel is aged at least 48 hours between about 290 K and about 300 K.

12) The method of claim 1, wherein the porous support and gel are heated to a temperature between about 420 K and about 500 K.

13) The method of claim 12, wherein the porous support and gel are heated to a temperature between about 465 K and about 480 K.

14) The method of claim 1, further comprising repeating steps d) and e) at least once.

15) The method of claim 14, wherein steps b) and c) are repeated at least once.

16) The method of claim 14, wherein steps d) and e) are repeated until the SAPO layer is substantially impermeable to N_2 before performing step f).

17) The method of claim 16, wherein steps d) and e) are repeated at least twice.

18) The method of claim 1, further comprising washing and drying the support and the SAPO layer after step e).

19) A supported membrane made by the method of claim 1.

20) A supported membrane comprising a porous support and SAPO crystals which are present within at least some of the pores of the support and which form a layer on at least one side of the support, wherein the pore size of the support is greater than about 0.2 microns.

21) The membrane of claim 20, wherein the SAPO is selected from the group consisting of SAPO-5, SAPO-11, SAPO-16, SAPO-17, SAPO-20, SAPO-31, SAPO-34, SAPO-35, SAPO-37, SAPO-40, SAPO-41, SAPO-42, and SAPO-44.

22) The method of claim 21, wherein the SAPO is SAPO-5, SAPO-11, or SAPO-34.

23) The method of claim 22, wherein the SAPO is SAPO-34.

24) The membrane of claim 20, wherein the thickness of the SAPO layer is less than about 20 microns.

25) The membrane of claim 20, wherein the porous support has an average pore size greater than about 1 micron.

26) The membrane of claim 20, wherein the porous support is in the form of a tube and the SAPO crystals are present within the tube pores and form layers on both the inside and the outside of the tube.

27) The membrane of claim 26, wherein the thickness of the SAPO layer is less than about 20 microns.

28) The membrane of claim 26, wherein the SAPO crystals are SAPO-34 and the CO_2/CH_4 separation selectivity is greater than about 200 for an approximately 50/50 CO_2/CH_4 mixture at about 250 K with a pressure differential across the membrane of about 3 MPa

29) The membrane of claim 26, wherein the SAPO crystals are SAPO-34 and for CO_2/CH_4 separation the CO_2 permeate concentration is greater than about 99% for an approximately 50/50 CO_2/CH_4 mixture at about 250 K with a pressure differential across the membrane of about 3 MPa.

30) A method for separating a first gas component from a gas mixture containing at least a first and a second gas component, the method comprising the steps of:

a) providing a membrane of claim 20, the membrane having a feed and a permeate side and being selectively permeable to the first gas component over the second gas component;
b) applying a feed stream including the first and the second gas components to the feed side of the membrane;
c) providing a driving force sufficient for permeation of the first gas component through the membrane, thereby producing a permeate stream enriched in the first gas component from the permeate side of the membrane.

31) The method of claim 30, wherein the membrane is a SAPO-34 membrane, first gas component is carbon dioxide and the second gas component is methane.